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WHITE FLY ERADICATION

BY

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Since the publication of Circular 30, "White Fly in California," by this Experiment Station, the insect has gone through another full generation. Very strenuous though misdirected efforts have been made towards its eradication, but the problem to-day is many fold more difficult, and the possibility of its suppression much more doubtful than a month ago.

A very large proportion of the insects have been destroyed through these efforts, but not one acre of infested territory has been cleared, and it requires just as thorough defoliation where there are but five white flies as though there were five thousand. Moreover, for the remainder of the summer, winged individuals will be continually coming forth, making the chances of its spreading to other localities a very serious matter.

We are now, therefore, confronted with a new set of conditions and should take a new view of the problem and prepare to meet the new conditions wisely, avoiding the mistakes of the past campaign.

What Has Been Done.

The white fly was discovered early in May, and the first work towards its eradication was done on the 22nd of June. The greater part of the defoliation, however, was done during the present month. How large the task was, one can have little conception from a cursory examination of the town. An examination of the map presented in this circular will enable one to get a comprehensive, though still inadequate, idea of its magnitude.

We have attempted in this map to show the location and present condition of every citrus tree in Marysville. The map is probably not absolutely accurate, since it was drawn from what could be made out without entering the lots, and very likely a few trees have been overlooked, but it will give a fair idea of the present situation.

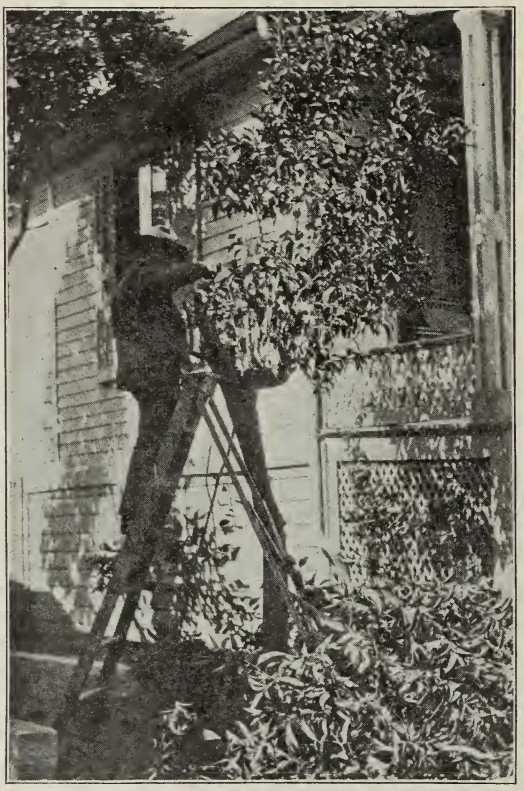


Fig. 1. The method of defoliation most commonly adopted.

Besides the citrus trees, we have indicated in this map the position of the electric and steam railways, because they may be supposed to afford the most ready means of transporting the insect to other parts of the State. The territory that was found badly infested this spring, all lay in a strip along the street-car tracks between B and I streets; in no case as far as our observations went were the over-wintering individuals found farther than two blocks from the street-car tracks. The flies of the spring generation, however, spread the infestation two or three blocks, extending their range at certain points to the Southern

Pacific tracks. We did not discover any evidence of the insect on the other side of these railroad tracks. It would, however, be impossible to say that they had not passed beyond. We have but little doubt that the more outlying districts have always been free from the pest. A study of the map will show that these trees were defoliated as promptly, and nearly as completely, as the center of the town. The method of defoliation ordered by the State Commissioner of Horticulture was that illustrated in fig. 11. The majority of the citrus trees in town are high pruned, so that the work must be done from a step-ladder. Fig. 1, from a photograph taken by Professor Clarke

Fig. 2. The top of a defoliated tree, showing careless work.

on July 12, is a very good illustration of the method of handling the trees.*

Some of the work was well and carefully done, but there are many examples of very bad practice. A typical case of bad work is shown in fig. 2. There was very little skilled labor to be had, and the owners themselves, in most cases, knew but little about the handling of trees. A man with a saw and a white-wash brush, if he made a pretense of knowing about trees, could command from seven to ten dollars a day.

After cutting the trees, the brush was usually thrown into the street, and the city undertook to have the rubbish removed. This removal of the brush is the only assistance the citizens have received in the work, and no attempt has been made to secure uniformity, either

* I am indebted to Professor Clarke for most of the photographs in this circular.

Fig. 3. A brush pile in the street.

Fig. 4. Another larger brush pile.

in the time of cutting or in the disposal of the infested leaves. In some cases they were left on the ground beneath the trees, and in other cases the city allowed the brush heaps to remain in the streets or alleys till the flies emerged and until the adjacent trees were out in foliage again.

Fig. 3 is a fair example of this practice. On the left, the trees belonging to one lot have been cut for some time, the trunks white-washed and the brush which was thrown into the street removed. On the right, the trees were just being defoliated on July 20, the date the photograph was taken.

Fig. 5. Loading brush for removal to the dumps.

The quantity of the brush that had to be disposed of was very large, for most of the trees were quite old, some upward of thirty years, and they had been allowed to grow as large as they would. The brush piles, therefore, on the sides of the streets were often very large. One of the larger piles is illustrated in fig. 4. In this case, however, the pile is composed in part of osage orange, which also was cut in some cases, though most of the osage orange in town is still standing.

The brush was gathered on wagons, as shown in fig. 5, and taken to a dumping ground, there unloaded, and allowed to dry ready for burning. No precaution was taken to prevent the scattering of infested leaves along the streets, and indeed dried orange leaves may be

found almost anywhere, though not numerously enough to be very conspicuous.

There were three dumping places used for the disposal of the brush. One of these was on the swampy land near the Southern Pacific tracks, within a hundred yards of orange trees. This dumping ground was only used a short time, however, though the brush is not yet burned. The greater part of this material was taken over the dyke and unloaded at G and Second streets. We show, at fig. 6, a bird's-eye-view of this dumping ground, taken from the top of a willow tree along the dyke near G street, looking across the sand-flats where

Fig. 6. A dump heap on the river.

the dumps are and the river toward the Yuba City side. To the left will be seen the ashes of the trees brought to the dumps up to about July 12, the rest of the brush has accumulated since that date. The brush heaps occupy perhaps four or five acres.

A rough estimate made by Professor Clarke and myself of the contents of this dump pile is as follows: Brush from citrus trees, 85 per cent.; osage orange, 10 per cent.; persimmon, 3 per cent.; privet, 2 per cent.; with very small amounts of jasmine, honeysuckle, bridal-wreath, rose, fig, and palm.

The fact that the white fly was already on the wing in great numbers as early as the 12th of July, and that practically all of the brush shown in fig. 6 was taken there after that date, shows that the insect was given ample time to develop before defoliation. The presence of new foliage on trees all over town shows further that the insects had

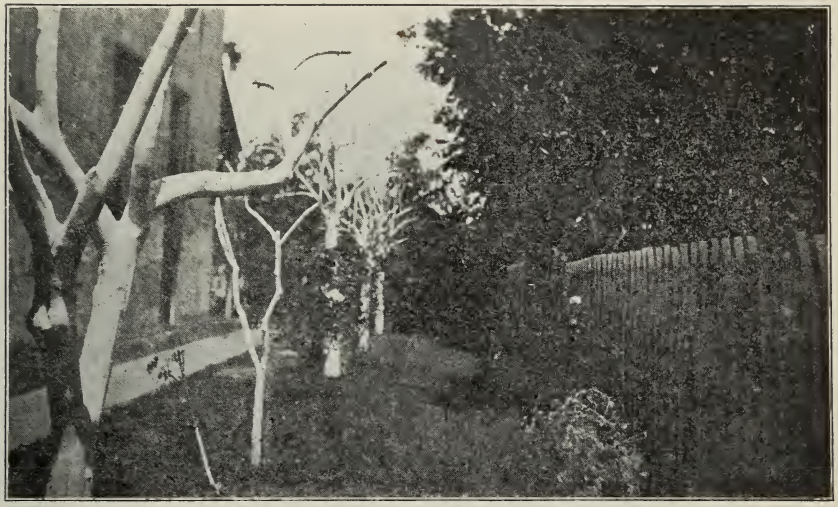
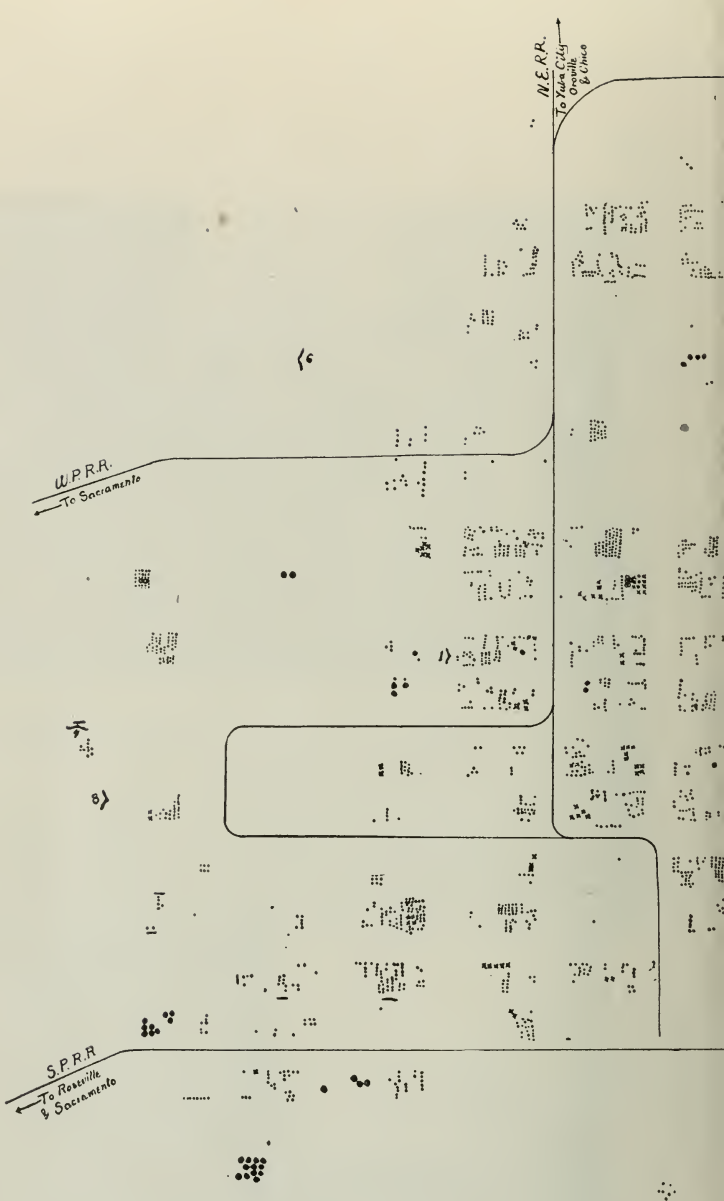


Fig. 7. Orange trees in foliage and defoliated.

Fig. 8. Small potted orange trees that escaped the inspector.



Map of Marysville
Railroad Lines
and condition of
Orange & Lemon Trees
July 20 1907

- undefoliated trees
- o partly defoliated
- · defoliated
- x with new foliage
- — brush piles on the street
- ⟩ figure in this circular

S.P.R.R.
To Yuba City
& Sacramento
S.P.R.R.
To Oroville
& Chico

no lack of young foliage on which to deposit their eggs. Fig. 7, from a photograph taken as late as July 20, illustrates how trees were allowed to remain in foliage long after the neighboring trees were defoliated, so that, as the new leaves came out, the white flies were right at hand. The inspection of the map will show numerous cases where even in the same lot one or more trees were untouched while the rest were defoliated. It does not show many other cases where these favored trees were finally cut down, but not till after they fur-

Fig. 9. One of numerous undefoliated trees.

nished winged insects to infest neighboring trees just coming out again into foliage.

In the map and in most of the discussion above, the citrus trees alone have been considered. These alone have been cut out with any attempt at thoroughness. Some of the other food plants have been quite as heavily infested as any of the orange trees.

The original order of the State Commissioner did not include all. The newspaper articles urging active work have usually been quiet in reference to other food plants, and the people generally seem to have lost sight of the fact that the defoliation of such plants is quite as

important as the orange trees. The fig is extremely abundant in Marysville, and is known to furnish food for the young insect, but practically nothing has been done towards defoliating these trees. This is a case of an occasional food plant, for we have not seen a single infested fig-leaf in Marysville. The insect evidently prefers the orange, but it is certainly not wise, when complete eradication is attempted, to utterly neglect a possible source of reinfestation of the orange trees. Figs and oranges are in immediate contact all over town, an example of which is shown in fig. 10.

Fig. 10. Adjacent Fig and Orange trees, the latter defoliated.

New foliage on the trimmed orange trees was reported in the Marysville papers by the 10th of July, and was to be seen even earlier than that. It is now to be found in all parts of the town, as shown on the map, where only the more conspicuous examples were noted. In many cases the new shoots are over a foot long, and some quite two feet long. In such cases the young leaves have been subject to reinfestation for a full two weeks at the date of this writing. Those in charge of the work are still trying to force further defoliation. Under the circumstances it is hard to see how any good purpose could be

served by further action at this time. The opportunity for effective work along these lines is past; now we are face to face with new conditions.

What to Do Next.

Some are ready to advocate that we do nothing. They are ready to trust to the chance that it may not spread from Marysville into the orchard districts, or if it gets there, that it may find the conditions unfavorable to it, or that some parasitic insects may be discovered that

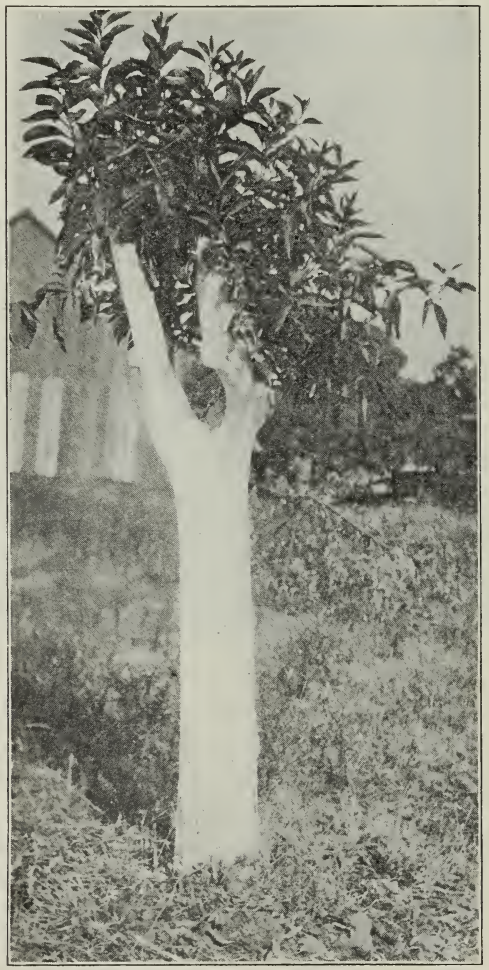


Fig. 11. Defoliated tree coming into foliage.

will render it innocuous, or some other contingency making its destruction unnecessary.

Granting that any or all of these contingencies may occur, it is nevertheless the part of wisdom to make a determined fight as long as there is a reasonable chance that it may be exterminated.

The failure of the past campaign need not dishearten us in any particular, for, as the account of the work given above clearly indicates, the management of the past campaign has been fundamentally bad, and its history chiefly useful in pointing out how not to do the work.

There are only two periods of the year when the eradication of the white fly can be undertaken with any reasonable hope of success. They are the two periods when all the individuals are attached to the leaves and possess neither wings nor legs. The longest and best period for the work is during the winter. While the insects may be able to feed and grow during this period, coming gradually to full size, they are finally brought to a standstill, being unable to transform into the winged condition until the weather is warmer. Thus it comes about that the insects that were of all sizes in the fall, reach the winged condition in the spring at the same time. Both preceding and following this great spring brood of flies there is a period when all are wingless. All through the month of May and well into June the insects of this spring brood were on the wing and laying eggs. Some of the young hatching from these eggs were fully a month older than the youngest members of the family. Thus there is only a brief period during which successful work could be done. The quiescent period of winter is much longer.

From early in July, through the remainder of the summer and probably until killing frosts come, the insect is continually on the wing, owing to the overlapping of broods, rendering eradication at this time hopeless.

Summer Work.

While the insect cannot be eradicated at this time of the year, there is much important work to do, upon the doing of which the success of next winter's campaign will depend.

The man put in charge of the work should begin at once, and have a sufficient number of assistants to do it thoroughly. These assistants should be selected for three different classes of work, and each group put in immediate charge of an expert in that particular line. These three lines of work should be as follows:

First—A horticultural staff should be selected, whose first work should be to assist the people of Marysville in making trees again out of the stumps now standing. They are in need of expert assistance. This staff must prove to the citizens of that town that they are endeavoring to be genuinely helpful, that this campaign will be managed with their interests uppermost. They will also make themselves familiar with every detail of the situation and be ready to take immediate charge of the defoliation of next winter.

Second—There should be a staff of inspectors, working both in Marysville and the surrounding country, continually on the search for infested trees. The work of this staff will have to be continued for at least a year after the last white fly is seen.

Third—A staff of investigators should make an exhaustive study of the habits of the fly, particularly testing out experimentally the possible range of the food habits of the insect. We ought to be in a position to say, with full confidence, just what plants to take into consideration in the winter work; furthermore, we must know, beyond question, whether the insect can live on fallen leaves, as so many species of white flies do, so that we shall know what to do with deciduous trees. Finally, this staff shall be the place of appeal for the other departments of the work.

The summer work, as outlined, is necessary to make a sound foundation for the winter's campaign.

Winter Work.

The character of the winter work has been foreshadowed in describing that of the summer. The exact course to follow will depend, in a large measure, on the results of the summer's investigation. Certain general plans can, however, be now given.

The horticultural staff would have to be greatly enlarged and separated into two divisions. To one would be given the defoliation work; to the other, the cleaning up and disposal of infested material. The latter division would act as a check upon the former division, and the staff of inspectors following them would insure that all is thoroughly done.

This plan of campaign involves that the actual work of defoliation be done by those in charge of the work, and is the only practical method of securing uniformity and thoroughness. The cost of the work should not be assessed against the owners of the properties involved. The work of defoliation should be completed as soon as pos-

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sible after all eggs are laid in the fall and the winged forms have disappeared.

A programme of work, like that outlined above, does offer some hope of the eradication of the pest; but unless ample provision is made for it and scientific accuracy and thoroughness insured by the appointment of the right kind of men to organize and direct the same, satisfactory results will not be secured.